

Does the change in tempo affect the attention span?

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Abstract

The proliferation of the music industry and corresponding consumer adoption in recent years has precipitated a paradigm shift, significantly altering the ways customers engage with music. Music has always served as the best medium for expressing feelings and emotions, as well as telling stories. The variety of music available and the 7.31% growth rate provide listeners with limitless options. It acts as an incentive for some while increasing concentration for others. Others argue that it is a distraction and reduces productivity. Music is a powerful medium with both positive and negative aspects.

However, according to some studies, depending on the type of task at hand, listening to music can be beneficial. Although the goal of playing music while performing tasks might make the task stimulating enough, the impact of background music on how efficiently individuals perform is unclear, the impact of background music on how well people accomplish cognitive tasks is a heavily debated subject. There are various researches done on the focused attention on various types of music- classical, traditional instrumental pieces compared to no music environment. But the frequency of occurrence from a preferred set of music for most individuals is from the genre, Pop. This study attempts to evaluate how different tempos of background music can affect the cognitive performance with songs of different tempos from a specific genre, by calculating the focused attention, retention and working memory.

Keywords:

Focused Attention, Retention, Working Memory, Pop Music, Tempo

Introduction

Music, in general, plays a powerful social role in assisting communication, influencing cognitive functioning, stimulating deep emotions, and influencing the establishment and maintenance of social groups. It can affect negatively or positively affect the physiological, psychological, and social of a human being when subjected to different contextual environments. Because of its strong dependability, emotional support, and enjoyability, the vast majority listen to it unaware of the consequences of its unintentional and prolonged usage.

Language and music are both complex analytical systems that interact with attention, memory, and physical performance. With the constant exposure to dopamine involving activities of the modern era, the brain has a constant need to be highly stimulated. Feelings of meaninglessness in daily tasks, as well as a persistent negative affect, are symptoms not only of boredom, but also of more serious efficacious dysfunction, most notably depression. As a result, attention lapses may have implications for both cognitive and emotional aspects of distress. The introduction of music can solve this need by providing people with constantly new experiences, satisfying the low tolerance for boredom.

Because it is so easy to find on the internet, background music is becoming more common in everyday life. The variety of music available and the 7.31% growth rate provide listeners with limitless options. Many people listen to music while doing mundane tasks like cleaning, cooking, working, and driving. (Chie, Q.T., & Karthigeyan, K.2009)

Although many people listen to music while performing tasks requiring concentrated attention, there is no consensus on how it influences. Background music and focused attention have been researched for years, with varying results and ambiguous conclusions; some studies claim a positive influence of music, while many others conclude the opposite. Although focused attention is required for effective performance, it is difficult to maintain focus on task-relevant information for an extended period of time, especially if the task appears to be less stimulating, which is why most people prefer to use music to accompany the task. (Gurgen, Elif. 2016)

Attention is an essential tool for good intellectual performance and thus plays an important role in the development of intellectual, cultural, and conversational skills. Several studies on preterm infants have discovered that differences in attention deficit can predict later cognitive and behavioural functioning. Furthermore, attention control is related to academic achievement

in school-age children. Attention skills develop gradually beginning in infancy through engagement with one's environment. Exploring the outside world, as well as orienting to, switching between, and maintaining focus on events, objects, and tasks. When these fundamental skills are hampered, there may be negative consequences for cognitive, social, and communication skills; thus, it is critical to learn more about the potential therapeutic effects of music intervention on these skills. (Kiss, L., Linnell, K.J. 2021)

Personal learning experiences may also have an impact on attention function; background sounds may also have an impact on worker productivity, continuity, and attention performance. Attention and memory cannot function independently. Memory is an important factor when it comes to learning, therefore how much music assist in activities like learning is incomprehensible. Various studies have also demonstrated that the preference for background music from different genres can also be used to analyse the listener concentration and performance.

Literature Survey

According to Flow Theory, when one is consciously immersed where one's skills are measured to the challenge of the activity, one can approach an ideal condition of experience known as "flow" (Nakamura, J., Csikszentmihalyi, M. 2014). Often, in a low-stimulating task, music can help engage the user initially, until the user reaches the flow experience and can zone out completely. In such cases, music is purposefully used to induce a positive mental state in order to boost productivity. When the challenge does not match the skill level, it can lead to boredom; however, the music implemented here will help users maintain their attention and focus on the activity for extended periods of time.

The classification of music necessary to attain ideal stimulation and effectiveness vary from person to person. Nonetheless, probing assessments of the effect on focused attention of qualities of preferred music stimuli, such as tempo, lyrics, and genre, as these have all been proven to help affect attention and effectiveness, are being conducted.

Numerous studies suggest that, when compared to other patterns, music tempo is a main indicator of mental changes induced by music. The consequences which music may exhibit are the result of complex interactions that include not only the structural characteristics of auditory

stimuli, i.e., sensory input, but also cognitional contributions from memory association and recollection.

People listen to songs of various genres, including mainstream music, while working at a variety of job sites, including stores and hospitals. Many psychologists and management experts investigated the potential impact of music on human workplace behaviour. Background music has the ability to influence human behaviour. In terms of background music rhythm, it was discovered that individuals who exercise pick up their work rate to complement music with a higher tempo and slow down to match songs with a slower pace. Music tempo has been found to influence listeners' heartbeats. Music tempo as the speed at which music is played, usually measured in beats per minute (bpm). The idea to introduce music tempo into this memory study was derived from the theoretical basis stated below.

According to one study, the influence of music on multiple tasks had a positive effect on literacy tasks such as comprehension. Participants who rarely studied with background music performed significantly better in a laboratory study when they learned in silence, whereas those who frequently studied with music performed significantly better when music was present. Slow, soft, repetitive low-information music was discovered to provide the most stimulating environment for learning literacy tasks. The music used to investigate the study here was composed by Mozart. (Chie, Q.T., & Karthigeyan, K.2009) (Scheufele P. M. 2000)

Regardless of the fact that most research findings found that music with a faster tempo was able to improve performance in comprehensive, spatial, and cognitive tasks, music at 60 bpm has been demonstrated to generate a state of calmness in both children and adults, as 60 beats is thought to be the optimum resting heart rate for the human body. As a result, 60 bpm music serves as a type of relaxation training, allowing listeners to slow their heart rhythm to match the musical beat. This slower heart rate promotes relaxation while also possibly promoting focus and concentration. (Chie, Q.T., & Karthigeyan, K.2009) Based on the research cited above, it is possible to conclude that music with particular characteristics has an effect on task performance. (Mollakazemi, M. J., Biswal, D., Elayi, S. C., Thyagarajan, S., & Evans, J. 2019)

The genre of pop, framed from the word 'Popular,' is what is mostly popularly listened to by all people. It most often consists of simple structures and tunes. The human brain enjoys patterns, and patterns that are easy to recognize are preferred over difficult ones. Patterns

enhance the appeal and engagement of music, and easy and simple patterns are easier to discern, which is why our brain prefers them. In addition, because most songs revolve around same themes and topics, pop music tends to repeat its patterns, rhythms, and lyrics.

Although there has been various researchers attempted to find the attention and working memory conducted on ranging genres of music, there has no exploration done on the most popular genre of music, pop and rock. The tempo within this genre can have a wide variation of tempo, rhythm and tune. In this study will we aim to see how different tempo on background music impacts the distribution of attentional states, as well as the effects of time-on-task on working memory.

Objective

In conclusion, most studies show that different genres of music can be used to conduct activities with varying genres. Music of varying tempos is also used to induce various emotional states, which can both relax and stimulate an individual's mind, allowing them to perform better by improving their cognitive, spatial, and arithmetic abilities.

However, little is known about the effect of repeated exposure to tracks from the same genre on working memory. We hope to provide a preliminary understanding of the difference in attention span between individuals when exposed to different tempos of pop background tracks in this study. The goal is to comprehend individuals' working memory when subjected to a specific task, subjective reports of attentional states, and the effects of time-on-task on working memory. The current study aimed to provide a richer and more informative measure of attention while the participants were engaged in different tasks while subjected to varying beats per minute (tempo) of a particular genre.

Methodology

I. Participants

There were a total of 20 participants, with 6 (30%) males and 14 (70%) females. The participants' ages range from 16 to 23, with a mean of 19.5 years. All participants were Srishti Manipal Institute of Art, Design, and Technology undergraduate and postgraduate students. Participants were approached at random to take part in the experiment. There were no restrictions on the participants' gender, race, or nationality. At the conclusion of the experiment, they were asked to describe their experience while performing the task.

II. Procedure

Each participant was provided with two different probes, and six different audio stimuli were played while they were engaged with the probes. The various audio stimuli were played one after the other, with a one-minute interval between each audio stimulus. Participants were instructed to read articles while the audio stimulus was played. Another probe included a memory experiment in which participants were instructed to memorise and repeat. During observations, the scores for each probe were recorded, and users were asked to summarise how they felt during the experiment when the various audio stimuli were played. The following audio stimuli were played: no music, slow, medium slow, medium, medium fast, fast. The experiment results were further processed using ANOVA to validate the hypothesis.

III. Materials

The trending music from the popular played genres in the 2000s, pop and rock, were used in performing the experiment. All the songs were selected based on the data that illustrated by Tim McGlinchey. 2022, tracks from the popular genre were divided into roughly five different tempo group conditions: 20 -70 beats per minute, 70 - 90 beats per minute, 90 – 110 beats per minute, 110 -130 beats per minute with overall group slow, medium-slow, medium, medium-fast, fast respectively. (Tim McGlinchey. 2022).

Difference in Tempo	Songs for each tempo	BMP for each song
Slow (20-70 BPM)	Make You Feel My Love	69
	Say Something	70
	Bohemian Rhapsody	70
Medium - Slow (70- 90 BPM)	Danze Kudro	89
	Roar	90
	Mirrors	7
	Stay	102
	Calm Down	107
	Perfect	95

Medium

(90 - 110 BPM)

Medium - Fast (110-130 BPM)	Gangnam Style	130
	Dynamite	120
	Right Round	125
Fast (130 - 200 BPM)	Easy on Me	142
	Animals	190
	Old Town Road	136

Table 1: Songs chosen for different audio stimuli from different tempos

The six different audio stimuli prepared were mixed and made into 1 min 30 seconds tracks. The six stimuli were named: No music (because no music was played) and mix tracks of slow, medium- slow, medium, medium- fast, fast as a whole.

Articles written by James Clear were used to assess Reading Comprehension. They were all part of an overarching domain of 'Life Lessons' and 'Creativity,' with similar reading complexities. They were ensured that each paragraph had an equal number of words, and the number of words for each paragraph was counted and written under each paragraph.

Schultz table were shown the to evaluate each participants' attention and retention. To ensure consistency with each audio stimulus, 5x5 black and white tables were chosen.

18	20	2	22	10
19	16	6	9	3
5	23	1	21	24
13	25	4	15	8
12	7	11	17	14

18	3	13	21	17
5	14	20	11	10
25	24	23	19	15
7	2	22	4	12
6	9	8	16	1

Figure 1: Schultz Table used for attention and memory retention.

IV. Data Acquisition

Each participant was approached at random and asked to devote 20 minutes to the experiment. Each participant was subjected to twelve rounds of one-minute sessions. The first six rounds consisted of showing the user memorising the numbers in order for 40 seconds and repeating the numbers with six different audio stimuli. Participants were asked to read the article aloud during the second half, and the number of words under each audio stimulus was recorded. There is no music, slow, medium slow, medium, medium fast, and fast audio stimuli here.

Audio Stimuli	Article Reading	Schultz Table
No Music		
Slow		
Medium Slow		
Medium		
Medium Fast		
Fast		

Table 2: Observation table used to record readings.

Towards the end, each participant was asked to describe how she/ he felt during the experiment and they were given a questionnaire to fill on the general. The questionnaire was given with the intention of understanding the background of each participant. Some of the questions being: do you listen to music when you work, what kind of music do you usually listen to, how do you prefer listening to it, do you frequently lose focus and vibe to the song playing while working, why do you listen to music in the background, does it take longer to finish work when you listen to music, with what kind of work do you usually listen music with, what are you not able to do while listening to music. The experiment concluded with an explanation of the entire activity, and the participants were eager to see their scores and analyse their data.

V. Results

Separate analysis of variance (ANOVAS), with time (independent variable), attention and retention(dependent variable) were used to test the data gathered. The six audio stimuli: no music, slow, medium slow, medium, medium fast, fast were used as fixed variables. Following were the hypothesis that were tested:

Hypothesis 1: There is no significant difference in attention span during a memory task when exposed to six different type of audio stimulus.

Hypothesis 2: There is no significant difference in attention span during article reading when exposed to six different type of audio stimulus.

The average attention span score for article reading showed a dependence on the background music. Users were noticed to lose focus on reading with faster tempos. Nevertheless, there were no significant differences between different audio stimulus for memorising and memory retention.

The general observations and remarks from the participants included the speed on which the articles are read depends on the interest of topic, the number memorization becomes an overload when its repeated again with each stimuli.

While conducting the experiment, it was noticed that participants who did not listen to music on a general basis, performed substantially better than participants who were regular music listeners. The different audio stimuli did not affect their memory capacity or attention while the experiments were conducted.

Another interesting observation that was noticed is when the general rules of the experiment is given, participants who were girls mapped out the numbers in different positions of the Schultz table. The male participants structured the number right after the other in the sequence presented.

Discussion

From the experiment conducted above it can be understood that music with different tempo i.e., beats per minute can have affect with the retention and attention on immediate comprehension of passages which is the active or working memory. Working memory here is contrasting to long-term memory, which is the vast amount of information saved in one's life, working memory is the small amount of information that can be held in mind and used in the execution of cognitive tasks. Working memory is the small amount of information that can be held in mind and used in the execution of cognitive tasks, in contrast with long-term memory, the vast amount of information saved in one's life.

Despite the fact that the tempo of the music had little to no effect on an individual's working memory, the participants quickly returned their focus to their ongoing task. The experiments are also short in duration; when they had been run for a longer period of time, the results would most likely have been different. With the track changes, there was less time required to be enhanced by the songs over time to achieve an optimal level.

In the first hypothesis, the expectancy of difference in the memory retention remained ambiguous as the person would block out the background music as sound when the experiment was held. It would have been interesting to see the results for the same activity for a longer period of time. In a given period of thirty seconds, there were not much difference with the audio stimulus played.

The background music with lyrics could have been an added distraction to the article read in the second hypothesis, as there was a significant reduction in the number of words read with different audio stimulus. Most participants appeared to retain information fairly well, despite the longer duration of time spent on each task.

A poorer performance caused by the change in different tempo was distinguished from when no music was played with respect to article reading compared to that of memory retention.

Furthermore, measuring the percentage of task-focus reports provided an indication of how close to optimal performance was. The optimal performance here remains unclear as it was subjective to different participants with the respect to their prior involvement with music. It was found that subjects in the current study who were familiar with the songs played were accustomed to distraction than others.

Conclusion

When working memory is not required, different tempos of music can be played to increase the desirability of the task. Tempo can have an impact on an immediate reaction to a situation or task that requires constant attention and focus. It would be interesting to see how attention and retention change for tasks that last longer.

Practical Implications & Scope of Future Research

In addition to the present study that focused on the beats per minute of different tracks, varying other elements of music can also be considered to evaluate the attention, retention and working memory of different individuals. This study can also be used to support the use of background music if there are no determining fundamental negative effects compared to positive influence it may bring. There can also be other stimulating background audio stimulus added to this to check the varying factor of distractibility.

References

Kiss, L., Linnell, K.J. (2021). The effect of preferred background music on task-focus in sustained attention. *Psychological Research*

Chie, Q.T., & Karthigeyan, K. (2009). The effects of music tempo on memory performance using maintenance rehearsal and imagery.

<https://musicforproductions.com/what-are-the-reasons-pop-music-is-so-popular/>

Nakamura, J., Csikszentmihalyi, M. (2014). The Concept of Flow. In: Flow and the Foundations of Positive Psychology. Springer, Dordrecht.

Scheufele P. M. (2000). Effects of progressive relaxation and classical music on measurements of attention, relaxation, and stress responses. *Journal of behavioral medicine*, 23(2), 207–228.

Mollakazemi, M. J., Biswal, D., Elayi, S. C., Thyagarajan, S., & Evans, J. (2019). Synchronization of Autonomic and Cerebral Rhythms During Listening to Music: Effects of Tempo and Cognition of Songs.

Gurgen, Elif. (2016). Social and Emotional Function of Musical Listening: Reasons for Listening to Music. *Eurasian Journal of Educational Research*. 16. 1-30. 10.14689/ejer.2016.66.13.

Tim McGlinchey. (2022) . How to Choose the Right Music BPM for Your Video

Diaz, F. M. (2013). Mindfulness, attention, and flow during music listening: An empirical investigation. *Psychology of Music*, 41(1), 42–58

Ashmita Mohan & Elizabeth Thomas (2020) Effect of background music and the cultural preference to music on adolescents' task performance, *International Journal of Adolescence and Youth*

Tze-Ming Chou, P. (2012). Attention Drainage Effect: How Background Music Effects Concentration in Taiwanese College Students.

Kamenetsky, Stuart & Hill, David & Trehub, Sandra. (1997). Effect of Tempo and Dynamics on the Perception of Emotion in Music.

Website check for BPM: <https://songbpm.com/searches/e1e13943-67fe-4262-afb2-8f7f9be36245>

Appendix

Table 1: Songs chosen for different audio stimuli from different tempos

Table 2: Observation table used to record readings.

Figure 1: Schultz Table used for attention and memory retention.



Figure 2: Participants trying to memorize the numbers in the Schultz Table